OCR
Oxford Cambridge and RSA

GCE

Applied Science

Unit **G623/01** and **G623/02**: Cells and Molecules

Advanced Subsidiary GCE

Mark Scheme for June 2017

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

Planning Exercise

An investigation to compare the effect of dough yield on the leavening action of sourdough starter cultures, made from one named type of flour.

Marking of the plan:

1 Read the material presented.
2 Then *award 1 mark* if *scientific terminology* has been used appropriately. Record using the letter Y.
3 Then re-read, this time point marking up to 24, by placing letters A to X in the margin where you see evidence of the marking criteria.
4 The same piece of evidence can be used to award one criterion only.

Marking Point	Marking Criteria	Mark	Additional notes
A	easily recognised safety procedures from: glassware (cuts) microbes/contaminants (biohazard) flour (irritant/allergen) electrical equipment (electric shock) waterbath/incubator (burns) water spillage (slips)	1	Evidence of something that is going to make doing the investigation safer – an active document, a working document related to the plan. **Need minimum of three**
B	prediction made;	1	Prediction related to comparison between ***dough yield /ratio of flour to water used, and the leavening action of starter [volume of CO_2 produced/ changes in acidity/ mass changes/increase in height, over time] in one named type of flour*** **Accept** single value for dough yield e.g.150
C	with justification;	1	Explanatory statement related to changes in CO_2 production/ decreases in pH/ changes in mass over time, related to dough yield and type of flour. E.g. number of microbes in flour, more water for metabolic reactions
D	description of preliminary work;	1	e.g. temperature /source of flour/ initial mass of flour/ initial volume of water/ narrow the dough yield range/ time of incubation/ time interval of 'feeding'/ method to measure leavening effect;
E	clear and in detail;	1	Clear description of **preliminary** practical work
F	reason (for doing it) explained;	1	Some explanation of why it's necessary for completion of the whole investigation.
G	clear and in detail;	1	Link to biological explanation.

Marking Point	Marking Criteria	Mark	Additional notes
H	at least two secondary sources of information identified;	1	State at least 2 references. (accept one reference to Wikipedia) Authenticated websites required. Full, URL/ description of named text; **Ignore** reference to teacher / insert
I	relevance explained;	1	Brief explanation as to how at least **one** reference helped in the planning. **Ignore** reference to insert.
J	basic practical skills and accuracy;	1	Simple method/list of instructions. Basic. Is it a feasible approach?
K	sound practical skills and accuracy;	1	Could someone follow the instructions unaided? Is it repeatable to appropriate degree of accuracy? Instructions to include: Range of dough yields used [more than one] (values not needed here) Temperature; Time; Measurement of initial mass of flour and volume of water; Suitable method of measuring leavening action of starter culture over time. One **named** type of flour used.
L	range of appropriate equipment listed;	1	List of names of main items of equipment and materials needed for the investigation. Generic terms: beakers, flasks, flour, water. etc are OK here. Should include flour, NAMED type not needed here
M	full range of appropriate equipment listed;	1	If any major item missing do not award, e.g. Top pan balance; measuring cylinders/ burettes; gas syringe/ pH probe/data logger; Must include **named** flour type **AND** one of each of: Number, e.g.5 beakers Capacity, e.g. 100cm3 (measuring cylinder) Volume/mass (of reactants)
N	appropriate number of measurements stated;	1	Reference to replicates/ use of repeats in main experiment – at least 1.
O	need for range of measurements stated;	1	Statement: e.g. to compare a range of dough yields using one type of flour to maximise leavening. This is expressed as change in dough volume/ volume of CO_2 produced/ change in pH.
P	appropriate range stated;	1	5 different **<u>appropriate</u>** dough yield values (100 -300), using one type of flour. Range to be agreed at SSU. Accept range of flour:water ratios = dough yield

Marking Point	Marking Criteria	Mark	Additional notes
Q	relevant variables are identified (stated);	1	At least 2 from: Source of flour; age of flour; initial starting mass of flour OR initial starting volume of water OR initial vol of starter culture; time of incubation; frequency of 'feeding'; temperature; method of measuring dependent variable.
R	how variables to be controlled explained;	1	How for at least 2 of the variables relevant to Q. e.g. time, mass, temp. **A quantitative description** is required
S	one suitable method to display data;	1	One display of results eg table, with clear headers & units
T	additional method to display data;	1	Any <u>different</u> display eg graph. with axes correct with labels & units. Allow ECF from S
U	simple data handling;	1	Evidence of calculation of initial dough yields; calculation of mean leavening [i.e. mean volume of CO_2 produced/ rate of CO_2 production/ mean decrease in pH].
V	possible conclusions; (Allow ecf if correctly related back to original prediction)	1	Statements of expectations or observations to confirm or reject prediction made in **B**. 'What would your results need to show to confirm or reject your prediction?' Accept an indication of optimum concentration from annotated graph.
W	recognises sources of error;	1	At least two examples: equipment/materials/specific human error (max one) Fluctuations in temperature; microbial content of flour; accuracy of measuring equipment; activity of wild yeasts/ Lactobacilli present; / residue left;
X	suggests methods for improving accuracy and or validity; (minimum of one needed)	1	**Accuracy**: relate to '**W**' or use of alternative technique(s). Expand critical range of dough yields/ optimum incubation times/ frequency of feeding starter cultures; AND/OR **Validity**: state aspect of collected data to be compared with secondary sources. Alternative method of measuring leavening/ use of different varieties of flour/ optimum performance, at pH/ temperature.
Marks	Maximum for plan = 25	24 + *1 (scientific terminology)*	

Abbreviations, annotations and conventions used in the detailed Mark Scheme.

/ = alternative and acceptable answers for the same marking point
(1) = separates marking points
not = answers which are not worthy of credit
reject **=** answers which are not worthy of credit
ignore **=** statements which are irrelevant
allow **=** answers that can be accepted
( ) = words which are not essential to gain credit
__ = underlined words must be present in answer to score a mark
ecf = error carried forward
AW = alternative wording
ora = or reverse argument

Annotations: the following annotations are available on SCORIS.

✓ = correct response
x = incorrect response
bod = benefit of the doubt
nbod = benefit of the doubt **not** given
ECF = error carried forward
^ = information omitted
I = ignore
R = reject

Question			Expected Answers	Marks	Additional Guidance
1	a	i	Sample A = Protein/peptides/polypeptides; Sample B = Starch **and** glucose/reducing sugar/ named reducing sugar	1 1	Additional incorrect response(s) negates mark **Both** starch and glucose/reducing sugar/named reducing sugar needed
	b	i	Ethanol **and** water/ Sudan III;	1	**Both** ethanol and water both required for the mark.
		ii	[milky/white] emulsion/ red dye associates with fat droplets/ red colour stains fat droplets/ red ring on surface of liquid;	1	Observation must be linked to answer in 1aii. (For SSU – consider 'milky/white' as an acceptable description?)
	c	i	Glycerol/alcohol;	1	
		ii	Unsaturated fatty acid chain = Z Double bond between carbon atoms [in hydrocarbon chain] OWTTE;	1 1	
	d		Phosphoric acid/ phosphate group, replaces one of the fatty acid chains.	1	
			Total	**8**	

Question			Expected Answers	Marks	Additional Guidance
2	a		Type of reaction = hydrolysis; Type of bond = ester/ covalent;	1 1	
	b	i	Measure, decrease/drop/lowering, in pH;	1	**Accept** universal indicator/ litmus/ pH probe **Ignore** 'change' unqualified
	b	ii	Fatty acid chains are formed	1	**Accep**t 'due to decrease in pH' [Test and reason MUST be linked].
	c		Substrate/triglyceride, concentration; *One from:* As, substrate/triglyceride, concentration increases rate of reaction increases; Positive correlation [between rate and triglyceride concentration]	1 1	**Ignore** refs to enzyme/lipase concentration **Ignore** 'concentration' unqualified ORA
	d		Rate, remains constant/does not change/ reaches a maximum/ stops increasing; All active sites occupied/ active sites saturated/ maximum number of enzyme-substrate complexes/ enzyme concentration is limiting;	1 1	 **Reject** enzymes used up/ **Reject** substrate limits rate of reaction; **Ignore** substrate no longer limits the reaction **Ignore** reference to temperature.
	e		*Any two from:* pH [of beads/reactants] temperature; volume of substrate/ triglycerides used; volume of enzyme/ lipase; size/number/surface area of beads	2	**Reject** if answer states pH of products
				10	

Question			Expected Answers	Marks	Additional Guidance
3	a		P = mitochondrion/mitochondria Q = Golgi (body/apparatus) R = nuclear <u>pore</u> envelope/membrame?	1 1 1	 **Accept** 'nucleus pore'
	b		**FIRST CHECK THE ANSWER** **If answer is 12500 award 2 marks** actual length of line = 5cm/50mm/ 50000µm ÷4 magnification = 12500	 1 1	 If units added: max 1 mark
	c		(i) ribosome(s); (ii) <u>smooth</u> ER; (iii) chloroplast(s);	1 1 1	Accept RER?? Ignore ER; reject RER.
	d		*Any two from:* Cheap to purchase; See live cells/colours?; Unaffected by magnetic fields; Preparation of material is quick/ simple/ requires less complex staining; Use of the **microscope** requires less training; Can observe more than 1 cell in field of view/ can use haemocytometer; Less chance of artefacts;	 2	**IGNORE reference to EM/ lower magnification/ lower resolution.**
			Total	**10**	

Question			Expected Answers	Marks	Additional Guidance
4	a		*Any two from:* Solvent [e.g. electrolytes/ glucose] Transport [e.g. hormones/ sex cells Habitat [for animals/plants]; Metabolite/ reactant [in chemical reactions]; Maintenance of blood pressure/ kidney function; Removal of waste products Temperature regulation (sweating);	2	To be agreed at SSU.
	b		**Level 0 [0 marks].** Candidate includes fewer than two correct valid points. **Level 1 [1 mark]** Candidate uses basic ideas to simply explain how cell volume may change, including at least two valid points. **Level 2 [2 -3 marks]** Candidate shows an understanding and partially explains how the cell volume may change, including **at least three valid** points expressed clearly and logically. **Level 3 [4 marks]** Candidate shows a high level of understanding and gives a full explanation of how blood cell volume may change may be used, including at least **five valid** points expressed clearly and logically.	4	Valid points to include: Ignore reference to movement of sugars/solute potential 1. Ref to water movement 2. By osmosis 3. Across a selectively permeable 4. Cell surface membrane 5. (Water moves) out of the cell/ volume decreases 6. When surrounding solution has a higher concentration (of sugars/salts/ solutes) than cell contents 7. Cell has a higher water potential 8. (water moves) down a water potential gradient / from high ψ to low ψ 9. Water moves into the cell/volume increases/ blood cells burst 10. When surrounding solution has a lower concentration of concentration (of sugars/salts/ solutes) than cell contents 11. Cell has a lower water potential
			Total	**6**	

Question			Expected Answers	Marks	Additional Guidance
5	a	i	all have the same shape/ only bind to PSA/ one type of/ specific, antigen	1	
	a	ii	(PSA) has a complementary shape; due to (specific) tertiary structure (of the antibody/ protein)	1 1	**Ignore** binds/fits unless qualified.
	a	iii	(excess) enzyme/ second antibody, would remain/ is removed by washing; enzyme could react with colourless substrate (when all PSA molecules combined)	1 1	
	b		*Any two from:* anxiety/depression/ mental health disorders; test may offer reassurance; early diagnosis improves treatment success; treatment for early prostate cancer has risks/side effects; whether or not to inform relatives / family members may not want to know whether or not to plan **further** children patient human rights e.g. confidentiality issues/ discrimination issues e.g. employment / insurance / mortgage facilities✓ religious issues, with explanation Test result may not be 100% accurate/ false positives/ false negatives; AVP;	2	To be discussed at SSU.
			Total	**7**	

Question			Expected Answers	Marks	Additional Guidance
6	a		*One from:* culture may not be uniformly sampled/ distributed; some of the cells likely to be dead / AW; dilution problems; human error;	1	
	b		*One from:* Cannot distinguish between dead and live cells; Counts inanimate particles e.g. dust; Requires trained personnel to setup/ calibrate the machine.	1	
	c		Eye piece graticule **and** stage micrometer	1	**Both** required for the mark
	d		Healthy cervix cells *One from:* Relatively large; Polygonal in shape; Cell boundaries defined; Cytoplasm is thin; Nucleus small; Nucleus is dense; Many occur singly;	1	**Accept** reference to positive smear result i.e. *One from:* Larger nuclei; Irregular shaped (nucleus); Nucleus, wrinkled/ indented/with protrusions; Nucleus, darker/hyperchromatic; Cells, clumped/ grouped together;
			Total	**4**	

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